Vol. 6.] 1933. [No. 2.

# AGRICULTURAL JOURNAL



*Issued by the*
*Department of Agriculture, Fiji.*

PRICE, ONE SHILLING.

BY AUTHORITY: J. J. McHUGH, GOVERNMENT PRINTER, SUVA.
1933.

# DEPARTMENT OF AGRICULTURE.

## STAFF LIST.

ADMINISTRATIVE DIVISION—

| | |
|---|---|
| Director of Agriculture (Acting) | A. B. Ackland. |
| Chief Clerk (Acting) | J. S. Rennie. |
| Clerks | E. J. Hart. |
| | N. G. J. McNally. |
| | Miss M. Garland-Mathews. |

VETERINARY DIVISION—

| | |
|---|---|
| Senior Veterinary Officer | C. R. Turbet, B.V.Sc. |
| Veterinary Officer | H. M. Stuchbery, B.V.Sc. |
| Stock Inspector (Temporary) | C. H. Koster. |

RESEARCH AND LABORATORIES DIVISION—

| | |
|---|---|
| Government Entomologist | H. W. Simmonds, F.E.S. |
| Government Chemist | W. J. Blackie, M.Sc., A.I.C. |
| Laboratory Assistants | Miss V. McHugh. |
| | G. F. Flemons. |
| | Vilitati Vavaitamana. |

PRODUCE INSPECTION DIVISION—

| | |
|---|---|
| Inspector of Produce (Acting) | A. B. Ackland. |

FIELD AGRICULTURAL DIVISION—

| | |
|---|---|
| Agricultural Officer | H. R. Surridge, A.R.C.Sc. (I) |
| Cotton Specialist | R. R. Anson. |
| Cotton Inspector | B. L. Field, A.M.I.E. (India). |
| Assistant Agricultural Officers | S. E. H. Coster. |
| | B. F. Hooper. |
| | D. A. Donald, H.D.A. |
| | L. H. Dietrich. |
| | B. E. V. Parham, M.A. |
| Assistant Agricultural Officer (2nd Grade) | W. L. Parham. |
| Field Assistant | C. M. Dass. |

GOVERNMENT RICE MILL—

| | |
|---|---|
| Manager | B. Lyon Field. |

COCONUT COMMITTEE STAFF—

| | |
|---|---|
| Entomologists | R. W. Paine, B.A. (Cantab.) |
| | T. H. C. Taylor, M.Sc. (Lond.) |

COCONUT COMMITTEE—

Acting Director of Agriculture (Chairman).
Secretary for Native Affairs.
H. E. Snell, B.A.
E. Duncan.
Major Willoughby Tottenham.

*Secretary*, J. S. Rennie.

# AGRICULTURAL JOURNAL

ISSUED BY THE

DEPARTMENT OF AGRICULTURE, FIJI.

VOL. 6.] DECEMBER, 1933. [No. 2.

## EDITORIAL.

IN our last issue it was reported that Mr. A. C. Barnes, Director of Agriculture, had accepted a transfer to Jamaica. He left the Colony to take up his new appointment on 5th August, 1933. He carries the best wishes of all his staff.

Dr. H. W. Jack, M.B.E., B.A., D.Sc., of the Federated Malay States, has been appointed to fill the vacancy thus caused and is due to arrive about June next. Meanwhile the Chief Clerk, Mr. A. B. Ackland, is acting as Director.

This will be the last number of the *Journal* issued this year and is being edited by the Government Entomologist, Mr. H. W. Simmonds.

Owing to the necessity of curtailing expenses it is only proposed to issue one number of the *Journal* next year.

The Government Entomologist was seconded for three months to the Administration of Western Samoa in order to make a preliminary survey of the pests and diseases attacking the principal economic crops in that country. He left Suva on August 25th and returned *via* New Zealand on November 17th.

The Government Chemist, Mr. W. J. Blackie, left on six months' leave on 24th November.

Mr. S. E. H. Coster, Assistant Agricultural Officer, returned from leave on 22nd September.

Miss V. H. McHugh, Laboratory Assistant, to the Entomologist, is temporarily transferred to the Colonial Secretary's Office as a relieving typiste.

## TAILEVU DAIRY SCHEME.

By A. B. Ackland, Esq., Acting Director of Agriculture.

After many years of Government control and many vicissitudes the Tailevu Dairy Factory has amalgamated with the Rewa Co-Operative Dairy Company Limited and now takes its place in the commercial life of the community entirely free of Government supervision.

The history of this Scheme for the settlement of Returned Sailors and Soldiers is well known to the local readers of this *Journal* and there is no need to repeat it in this article. A brief outline of the operations of the undertaking during the past seven years during which the Department of Agriculture has controlled the Scheme may, however, be of interest.

On the 1st May, 1926, the management of the undertaking was transferred from the Treasury to the Department of Agriculture, but the then Colonial Treasurer, Mr. H. H. Rushton, continued to play a large part in the management. The year 1926 was a most difficult one as a portion of the butter stocks deteriorated and had to be disposed of at reduced prices, improvements to the cold storage accommodation and the purchase of a new churn became necessary, and a large sum of money held at the factory was stolen.

At this time the operations of the undertaking were financed from an advance of £1,000 made by the Government. In view of the difficulties experienced in 1926 the advance proved to be insufficient, a further sum of £1,000 was advanced and it was necessary, eventually, to write off a sum of £3,165 11s. 5d. against the revenue of the Colony.

A new advance of £1,000 was made as from the 1st January, 1927, and the factory was operated from that advance until the amalgamation with the Rewa Co-Operative Dairy Company Limited became effective.

A loss of £466 1s. 5d. was made in 1927, but a loss on operations for that year was anticipated by the Special Committee of the Legislative Council which considered this dairy scheme in 1925.

The results of manufacturing and trading operations from the end of 1927 have been as follow:—

| | | | | | |
|---|---|---|---|---|---|
| Nine months ended | 30/9/1928 .. | .. Profit | £426 | 12 | 0 |
| Year ended .. .. | 30/9/1929 .. | .. Profit | 1,529 | 18 | 6 |
| Year ended .. .. | 30/9/1930 .. | .. Profit | 815 | 7 | 3 |
| Year ended .. .. | 30/9/1931 .. | .. Loss | 541 | 1 | 7 |
| Year ended .. .. | 30/9/1932 .. | .. Profit | 184 | 13 | 4 |
| Nine months ended | 30/6/1933 .. | .. Loss | 480 | 16 | 2 |

The intention of the Government, when the Scheme was commenced, was that a co-operative company of the suppliers should be formed as soon as the undertaking was established on a firm basis, and, when profitable operations appeared likely in 1928, an arrangement was made with the settlers that one-half of all profits made should be distributed *pro rata* to the suppliers and the remainder held by the Government in a reserve so as to provide capital for the proposed company. Later this arrangement formed one of the conditions under which Government continued the management of the affairs of the Scheme.

By this means a reserve fund was accumulated and deposited in the Government Savings Bank at Suva. The damage caused by the hurricanes and floods of recent years necessitated the grant of assistance to settlers in some cases, and as advances were made from the reserves, the accumulation of a sum sufficient to launch the co-operative company was not possible.

The reserve, however, enabled assistance to be granted to the settlers without any call on public funds. The settlers were, in fact, granted loans of their own money.

As a loss had been made in 1931 the profit of £184 13s. 4d. made in 1932 was not treated in a similar manner but was set off against the loss for the previous year.

The position, when the amalgamation became effective, was that the Government held a sum of £734 18s. 4d. in the reserve and there were losses totalling £837 4s. 5d. for the periods ending on the 30th September, 1931, and 30th June, 1933, which had not been recovered. The Government, with the approval of Legislative Council, decided to write off the accumulated loss against certain assets of the undertaking, referred to later in this article, and to disburse the reserve moneys to the settlers concerned.

Reference has already been made to the loss of £3,165 11s. 5d. written off at the end of 1926. Of this sum, £2,733 6s. 3d. was required to adjust the advances made by the Government. Certain assets such as stocks, &c., were not taken into account when adjusting the advance with the result that the undertaking inherited, on 1st January, 1927, assets worth £1,825 5s. 4d. The loss of £466 1s. 5d. on operations during 1927 was written off against these assets reducing the value to £1,359 3s. 11d. At the close of the undertaking the losses for the periods ending in 1931 and 1933 less the profit for 1932 were written off against these assets, leaving a balance of £521 19s. 6d. for which the Tailevu Dairy Scheme was responsible to Government. In addition there were certain interest and sinking fund charges made against the factory, the value of butter-fat supplied by a farm operated by the factory and the proceeds of sale of certain livestock in the hands of the management. It is estimated that when the accounts are closed the general revenue of the Colony will benefit to the extent of approximately £1,700 from these sources. The settlers have already been paid the sum of £784 13s. 4d. on account of the reserved profits held and the interest due thereon.

The terms on which the settlers occupied the farms provided for the payment in instalments over 18 years of the sum of £1,000 in respect of each farm. They provided also for rental charges of 2s. 6d. per acre per annum on flat land and 6d. per acre for hills although the head lease provided for payment of rent to the native owners at the rate of 5s. per acre for the flats, the difference in rent being met from general revenue. With the approval of the settlers the Government, with the consent of Legislative Council, has remitted the balance of the capital charges on the farms and has increased the rent payable on flat lands to 5s. per acre per annum.

The Rewa Co-Operative Dairy Company has admitted the Tailevu suppliers as shareholders in the Company on terms which the latter consider to be satisfactory and the new arrangement has worked smoothly during the past six months.

## ENTOMOLOGICAL SECTION.

### BIOLOGICAL CONTROL OF CLIDEMIA HIRTA.

By H. W. SIMMONDS, F.E.S., Government Entomologist.

I HAVE elsewhere* discussed the position regarding the control of this noxious weed by the thrips *Liothrips urichi*. It seems, however, advisable to review the position and bring the report up to date.

* *Bull. of Ent. Research*, Vol. XXIV, Part 3, Sept., 1933.

The thrips, *Liothrips urichi*, was introduced from Trinidad into Fiji in April, 1930, when, meeting with exceptionally dry conditions, it spread very slowly for the first ten months. With the advent of normal rains its increase was phenomenal, whilst it showed a surprising ability to cross wide areas of bush and sea, also to discover isolated clumps of its host weed. The season 1932, however, proved abnormally wet, leading to a considerable check in the numbers of the insect and to renewed growth of the weed in certain places in the wetter portions of its habitat. Early in 1933 normal conditions returned enabling the insect to again assume the ascendency.

As a result of the check on the growth of the weed brought about by the attacks of the insect other plants are now able to out-grow and over-run it. Chief of such successful competing plants are Sensitive (*Mimosa pudica*), Para grass, Mile-a-Minute (*Micania scandens*) and a native convolvulus. In many places the combined effects of the insect and this overgrowth have led to the collapse and death of the weed which has been replaced over considerable areas by Para grass and Sensitive.

In a recent visit to the Tailevu district it was observed that the conditions there had greatly improved in the past ten months and much of the sea of "curse" that formerly existed in a portion of that district is now greatly overgrown with other plants, particularly mile-a-minute and the wild convolvulus, whilst considerable attacks by dodder were also observed. Farmers can greatly assist the work of the insect by cutting down the old areas of the weed. The insect requires young succulent growth for its food and where old heavy areas are cut to the ground the attacks on the young plants which then spring up are generally so heavy that, if stock are kept off for a few months, the weakened weed, not able to compete with the surrounding vegetation, is choked out.

To the farmer much depends upon the nature of the new competing vegetation and every care should be taken to see that this new growth does not consist of other noxious weeds. To that end the ground should be prepared and good grasses sown. Where paddocks are well sub-divided and regularly rested it will be found to help greatly. A statement has been made that the weed is, when controlled by the thrips, quickly replaced by other weeds. This is not so. The weed is replaced by the dominant plants of the district. On good lands such will be Sensitive or Para grass, but on poor lands, unless helped by the farmer, other weeds will replace it and every effort should be made to avoid such. The great success which has attended the control of this plant by insect agency has led to a demand for similar action against other weeds and it would be as well to again stress the warning that against such plants as *Solanum torvum* which are closely related to cultivated crops such methods are far too dangerous to be entertained and that the number of weeds which offer possibilities of control by such methods is strictly

limited. There are still certain very wet districts in which the value of the thrips is at present limited although even there it is surprising how slight a check on the growth of the weed leads to the dominance of some other plant especially on the better soils.

## CREMASTUS SP. (?) PARASITE OF NACOLEIA OCTASEMA.

By H. W. Simmonds, F.E.S., Government Entomologist.

In the last issue of this *Journal* an account was published of the introduction of an Ichneumonid, *Cremastus sp.* (?) from Java, to assist in the control of the banana scab moth, *Nacoleia octasema*. The introduction took place in May 16th when 24 adult females were imported. Breeding was taken in hand and by November 30th, 4,479 adults had been raised, of which some 4,046 had already been released. The insect reproduces by parthenogenisis and during the course of the work only some six males have been produced. When these were introduced to females mating did not appear to take place and no families producing both sexes were obtained.

In addition to a number of localities on Vitilevu, strong colonies have been despatched to Beqa (207), Vanuabalavu (94), Taveuni (100), Ovalau (100), Moala (194), Kadavu (50) and Koro (96), whilst outside the Group 156 were released in Samoa. It is satisfactory to record that the insect has now been recovered from Tamavua in the Suva district showing that breeding is taking place.

It is of great interest that the Coconut Entomologist, Mr. R. W. Paine, has bred a moth apparently identical with *Nacoleia octasema* from the flowers of *Pandanus*.

## GARDENING NOTES.

By H. W. Simmonds, F.E.S., Government Entomologist.

### SLUGS.

These pests can be kept from young seedlings by placing pieces of wilted paw-paw leaves or rotting flowers of hibiscus around the beds. They show a marked preference for wilting foods and can be collected at night, when feeding upon such.

### HIBISCUS LEAF CURL.

Blowing powdered sulphur over the affected plants is very efficient for this trouble, which is caused by the attacks of mites.

### LETTUCE.

The value of green foods is so great that every effort should be made to obtain a continuous supply. The writer has obtained considerable success by sowing the seeds in tins and transplanting to fresh tins as soon as the first pair of leaves (cotyledons) are fully expanded, leaving plenty of room to grow (say, 15 to one-half kerosene tin). They can then be planted out in suitable weather without damaging the roots. Fairly good hearts have been obtained, even in December, by using this method and watering once a week with sulphate of ammonia. The variety grown has been mignonette.

CUTTINGS.

With most plants, cuttings have been most successfully rooted by using small laterals, with a slight heel attached. These laterals are best pulled off the main stem and then trimmed slightly.

ROCK MELONS.

The variety "Emerald Gem" has been found to withstand sun-scald under Fijian conditions more satisfactorily than most and at the same time produce a fruit of good quality under tropical conditions.

FRUIT FLY.

The two species of fruit fly which do so much damage to oranges and other fruits in Fiji can be trapped in great numbers by using an ordinary glass fly-trap, suspended from a tree and baited with the following mixture:—Scrubb's ammonia, 1 tablespoon; essence of Vanilla, 1 teaspoon; water, 1½ pints. This mixture which was evolved in Queensland has proved particularly attractive to the female flies of both the Fijian species (*Dacus passifloræ* and *D. xanthodes*).

CUT-WORMS.

These pests, which are the larvæ of various noctuid moths, are best controlled by the use of poison bait. A mixture consisting of 25 lb of bran (pollard) to 1 lb Paris Green, mixed dry, to which a little molasses is added, and then mixed with sufficient water to make a crumbly mass is scattered every third day where the pests are troublesome.

## VETERINARY AND ANIMAL NUTRITION SECTION.

### A SUSPECTED CASE OF MILK FEVER RECORDED IN FIJI.

By H. M. Stuchbery, Government Veterinary Officer.

Milk fever, or *parturient pareses*, a disease occurring rather frequently amongst dairy cows in other countries, has not apparently been previously recorded in Fiji, and the present Veterinary Staff have not hitherto noticed the condition.

The disease is of somewhat obscure origin, various theories being advanced to account for its cause. The most notable of the theories advanced are autointoxication due to the formation of some poison within the system, anæmia of the brain due to the increased supply of blood to the udder, with consequent lessening of supply to the brain, and lowered calcium or lime content of the blood. This latter condition is due to the sudden drain on the calcium content of the blood by the physiological action of supplying the necessary calcium to the milk. This theory is supported by the fact that a definite lime deficiency has been shown to exist in blood taken from cows suffering from milk fever.

The case under notice occurred on 20th April, the subject being an aged Short-horn cross cow. It was first seen about 6 p.m. when it was noticed to be lying down. All the characteristic symptoms of milk fever were in evidence, viz., the animal was lying down with all four feet under the body and the head turned sideways and resting on the flank. All attempts to make her rise were abortive.

The animal appeared to be in a semi-comatose condition. The eye appeared dull and the pupil dilated. Movements of the fæces and the urine appeared to be suspended and very little milk could be obtained from the udder. The extremities appeared to be very cold.

A tentative diagnosis of milk fever being made, the time honoured treatment of inflation of the udder with air was adopted. An effort was then made to make the cow comfortable. As she was lying in a wet patch, bags were placed under and around her and she was placed in a comfortable attitude. In about half an hour she appeared much brighter and it was then possible to give her a drench of stimulating medicine. The attendant was then instructed to watch her and keep her comfortable and warm.

The next morning it was found that the cow had got up of her own accord during the night and when seen she appeared quite recovered, being eager to eat and drink and possessing a moderate flow of milk.

The remarkable absence of milk fever in Fiji leads one to debate the reason. Certainly the disease is more common amongst the heavier yielding stock, but there is a sufficiently large number of cattle yielding milk in such quantities that would suggest a certain percentage at least of milk fever cases. It is an also recognised fact, too, that the disease occurs more frequently amongst hand-fed cattle, but a great percentage of the cases occurring in Australia and New Zealand come from stock at pasture.

A point of interest that might be raised is that calcium assimilation is aided by the presence of vitamin D, iodine and ultra-violet rays. The question rises, is there sufficiency of each of these agents present in their respective spheres to allow of rapid assimilation of calcium in foodstuffs, thus preventing loss of calcium content of the blood ? It is worthy of notice that rickets, a disease due to calcium and phosphorus deficiency and consequently affected by the absence of vitamin D, iodine and ultra-violet rays is not seen in the dairying districts of Fiji.

## CONTAGIOUS ABORTION CONTROL.

By C. R. Turbet, B.V.Sc., Senior Veterinary Officer.

During the last few years the incidence of contagious abortion in local dairy herds has been very slight and no reports of serious losses were received. There has been, however, a more or less continuous slight occurrence of abortion in certain herds. It was considered that these herds had a fairly high degree of resistance to the disease and since the number of abortions occurring were not seriously affecting the business of dairying, owners did not seek veterinary assistance.

Recently in several herds there has been a marked exacerbation of the disease, particularly amongst heifers, one owner reporting as many as 17 abortions amongst 21 heifers. This position must be considered as serious and the question of the best method of controlling the disease again becomes a matter of first importance.

The aim of control measures has been towards the complete eradication of the disease from dairy herds, some owners going to the extent even of destroying animals which had aborted, others sent such animals for slaughter at the abattoirs, others again endeavoured to maintain aborting animals in isolation. In some countries the maintenance of two herds has been recommended by some authorities and successfully conducted. The two-herd

system consisted briefly of the maintenance of a herd of animals found free from contagious abortion by means of the aggultination test, whilst the animals which reacted to the test were maintained isolated in a second herd. This method was costly and the risk was always present of the contagious abortion free herd becoming reinfected. In this country in its present state of development such a method is scarcely practicable owing to the great difficulty of maintaining absolute isolation. Fencing materials are not good and frequently after a short period posts rot and the owner finds his fences down and cattle straying. This is not particularly serious, except when it comes to a matter of disease control, and it would prove fatal to any method of contagious abortion control by means of isolation.

There has been in existence regulations to prevent the movement of animals from areas known to be affected with contagious abortion to areas that happen to be non-infected. We now know, however, that there are no dairying areas in Fiji entirely free from the disease and as a result the regulations are in abeyance.

It has been recommended that cows which have aborted should receive treatment by irrigation of the womb with various antiseptic solutions. This practice is not good except where it becomes necessary through retention of the after-birth and subsequent pus formation within the womb. The irrigation of the genital passage of cows which have aborted and passed the afterbirth has often been the cause of infection of the womb, with pus forming germs other than those of contagious abortion. This has been more particularly evident where owners had the treatment of several aborted cows on hand at the one time, where it was necessary to treat one after the other.

The writer has observed situations where an owner has been spending several hours a day irrigating the genital passage of cows suffering from purulent inflammation of the womb brought on by irrigation unnecessary in the first place. It is advised therefore that the wombs of aborted cows be not irrigated, the use of antiseptic solutions being confined merely to washing the discharges from the hind parts of the cow.

The aborted calf and fœtal membranes should be searched for and destroyed by burying deeply or by burning, since these are heavily infected with the germ of the disease and a potent source of infection to other cows. The cow which has aborted should be isolated for the tine being until discharges cease. Often it will be found that such an animal will come into normal milk if milking is persevered with at once. If the heifer is very young, however, it may be advisable not to milk her on this occasion, but to delay milking subsequent to the following calving. It is to be expected that the greater number of heifers which abort will come in calf if the bull is kept away from her for a period of from two to three months and the genital passage not interfered with. In a great majority of cases such an animal will hold her calf to the full period of the second calving. The aborted animal, therefore, still has a potential value as a milk-producing animal.

Where the incidence of contagious abortion in a herd is very slight it may still be advisable for an owner to endeavour to eliminate infected cows and to this end the application of the aggultination test to determine the infected animals is very useful. In this country, however, even supposing that all infected animals in a herd are discovered and culled from the herd the great risk always exists of reinfection and this matter has to be very seriously considered by an owner in determining what method he will adopt to control the disease.

Until quite recently veterinary authorities in all countries have been opposed to a general use of a vaccine in the control of the disease. The reasons for this have been that the only vaccine which has been found effective is one containing living organisms and which is not entirely devoid of danger since the living organism may produce the disease. The use of this vaccine directly conflicted with the method of control in general favour which was the wide use of the agglutination test and segregation of infected animals, in the hope that eventually abortion-free herds would be developed. The desired end has been obtained in some cases, but in a great number of occasions the total abolition of abortion from the herd has not been obtained in spite of the expenditure of considerable labour and capital. In fact the time has arrived when more attention must be given to the merits of vaccination as a means of control. By this method the disease can never be eradicated, but on the other hand the serious losses by failure to breed calves and lowered milk yield can be largely avoided.

At the present time it is generally accepted that the injection of living vaccine into suitably selected animals will raise the resistance or establish some degree of tolerance to the infection in the majority of cases. Under conditions existent in Fiji where eradication seems a hopeless proposition, vaccination seems to be economically sound.

By suitably selected animals is meant non-pregnant females and experience has shown that the most suitable period for vaccination is about two to three months before heifers are put to the bull.

The possibility of the control by vaccination is pointed out to owners who have failed to control the disease by other methods. The writer will be glad to discuss with such owners the practicability of vaccination.

The most satisfactory vaccine is one made from the strain of abortion germ actually responsible for the disease, hence the veterinary division should be given an opportunity of collecting material from the infected farm. This is most easily obtained from the recently aborted cow.

Owners should so arrange the service of their heifers that there is a considerable number ready for vaccination at one time. This will greatly facilitate the work and make it possible to do a greater number of animals.

## COCONUT MEAL.

THE following reply to an inquiry addressed to the Veterinary Division regarding the value of coconut meal as a concentrated food for horses, cattle and pigs may be of general interest and is published accordingly:—

We are of opinion that coconut meal is the best concentrate food available in Fiji for horses, cattle and pigs, the only drawback against its general use having been its cost. At £8 per ton retail it has been too expensive for local farmers to use in large quantities, considering the difficulty of marketing farm produce in Fiji and low prices obtained. The only users therefore, have been owners of private milking cows and riding horses and proprietors of dairies supplying milk.

Everyone, however, agrees as to its value as a feed and were its price lower it would be far more generally used.

It is fed mixed with other concentrates, such as rice-bran or cotton-seed meal or both of these, and also sometimes molasses. The quantity of coconut meal fed per animal is about 3 lb per day. It is first soaked with water when it will take up a quantity almost equal to its own bulk. The other concentrates are then mixed in with the coconut meal to make a moist mass. It should be just damp for horses, fairly moist for cattle and even sloppy for pigs.

Following are four different analyses of coconut meal:—

| Source. | Water. | Protein. | Carbohydrates. | Fibre. | Oil. | Ash. |
|---|---|---|---|---|---|---|
| Henry & Morrison .. | 9·6 | 20·9 | 45·3 | 11·2 | 8·1 | 4·8 |
| Loder's Meal .. .. | 14·21 | 21·99 | 39·59 | 12·12 | 5·59 | 6·5 |
| Pacific Oil Mills 1928 .. | 12·99 | 19·87 | 41·75 | 11·61 | 9·09 | 4·69 |
| Union Soaps .. .. | 13·15 | 25·76 | 37·62 | 11·64 | 7·53 | 4·30 |

It will be seen that the feed is very rich and taking the last analysis it will be found that the nutritive ratio is too close, viz., 1 : 1·8. This means that the proportion of protein to carbohydrate and fat is too great. This really constitutes the value of a concentrate as it can be used to balance roughage fodders in which the ratio of protein to carbohydrate and fat is too wide. The following balanced ration illustrates this point:—

| | Total feed. | Dry matter. | Protein. | Carbohydrate. | Fat. |
|---|---|---|---|---|---|
| | lb | lb | lb | lb | lb |
| Para Grass .. | 60 | 15·12 | 1·32 | 12·3 | ·18 |
| Coconut Meal .. | 3 | 2·6 | ·77 | 1·13 | ·22 |
| Rice Bran .. | 6 | 5·4 | ·65 | 3·4 | ·58 |
| | 69 | 23·12 | 2·74 | 16·83 | ·98 |

$$\text{Nutritive ration} = \frac{\text{carbohydrate} + (\text{fat} \times 2{\cdot}25)}{\text{protein}}$$

$$= \frac{16{\cdot}8 + 2{\cdot}2}{2{\cdot}74} = \frac{19{\cdot}0}{2{\cdot}74} = \frac{6{\cdot}9}{1}$$

$$= 1 : 6{\cdot}9$$

This is a fair average balanced ration for horse or cow.

The following extracts are from Henry & Morrison "Feeds and Feeding":—

(*a*) Coconut meal contains somewhat more crude protein than wheat bran and much more fat and has a higher feeding value. It produces butter of good quality and firmness and is well adapted for summer feeding. It may also be fed to horses, sheep and swine.

(*b*) Lindsay of the Massachusetts Station reports that when fed with a basal ration of 20 lb mixed hay and 2·5 lb wheat-bran, 3.7 lb of coconut meal produced substantially the same amount of milk as when an equal weight of gluten feed was fed. The yield of butter-fat was 6 per cent. greater on the coconut meal ration, possibly due to the oil in the meal causing a more or less temporary increase in the fat content of the milk, a finding also reported by European investigators. Scott, of the Florida Station, concludes from a feeding trial that a unit of protein from

coconut meal is nearly, though not quite, equal to a unit of protein in cotton-seed meal for milk production. A limited amount of coconut meal produces a firm butter of excellent quality, but when fed in excess of 3 to 4 lb per head daily it may make too hard a butter.

(*c*) The French War Department found coconut meal equal to the same weight of oats for army horses.

From the above reports it will be seen that this Division have no hesitation in strongly supporting the use of this meal as a valuable stock food.

---

## QUEEN BEES.

THE raising of early Queen bees for the New Zealand market is a possibility which might appeal to one or more Fijian settlers, and the following information extracted from the *New Zealand Journal of Agriculture*, and written by E. A. Earp, Senior Apiary Instructor, Wellington, should prove of interest.

### QUEEN-REARING.

DURING the summer months every attention should be paid to raising a stock of young queens to replace old and failing ones. Buying new queens each successive season is too expensive, and with a little attention and care good queens can be raised by the bee-keeper in his own yard, An apiary should be re-queened each year, and queens should not be tolerated for more than two seasons at the most. In the long run it is the queens that tell in the production of big crops, and unless the bee-keeper takes the trouble to re-queen in the summer only a small proportion of the stocks will yield a surplus.

Perhaps no branch of apiculture receives less attention than the production of young queens; and yet if bee-keepers who get the big crops of honey are asked what counts most in their production the reply is invariably "young queens." In New Zealand it has been proved over and over again that the best period for raising queens is from November to February. During these months everything is favourable for the operation, as the hives are at their highest state of prosperity, and under normal conditions the workers and drones are at their best.

It is best to breed only from pure Italian queens whose correct mating has been assured. Novices can judge the mating by noting the uniformity of the hatching brood as regards colour. Should the young worker bees show diversity of colour—some being yellow-banded and others quite black—the mating has not been correct. The question of mating is always a difficult one, as queens mate on the wing, and therefore it is impossible for the apiarist to select the sires. But as pure-bred queens, even though mismated, throw pure drones, it only takes a comparatively short time to eliminate cross-bred drones from an apiary. There is, however, still the chance of contamination from other drones in the neighbourhood.

To sum up the matter: By persistently breeding from the best it is possible to achieve wonderful results, while under careless management, or, as is often the case, no management at all, bees are sure to deteriorate.

Methods of queen-rearing are legion, but may be roughly divided into two classes—those which use the naturally built queen-cells, and those which necessitate the provision of artificial queen-cups into which young larvæ are transferred. The former method is most suitable for beginners, or for use

early in the season, as it minimises the risk of chill to young larvæ; while the second method is used largely by bee-keepers who want to rear queens in greater numbers.

*The Alley System.*—A simple, efficient, and easy method for raising queen-cells may be found in the Alley plan. It must be understood, however, that when raising queen-cells they require to be large and well shaped, and that any cells not up to size should be cut out. Procure a frame of young larvæ from the breeding-hive, and with a sharp knife proceed to cut every second row of cells down to the mid-rib of the foundation. Next kill two out of every three larvæ, and cut the comb into strips about one inch wide and full length of the frame. These strips are fastened with melted wax to cell-bars that hang about midway in a standard frame. The cells are pared down to about three-eighths of an inch in height, which gives the bees room to construct a solid base for the queen-cell. The frame or frames containing these bars, with the strips attached, may now be put into the hive previously prepared for their reception.

*The Miller Method.*—This method of raising queen-cells will be especially useful to the novice or to the bee-keeper wishing a few cells at one time. I is simple, easy, and under normal conditions never fails. No extra appliances are needed as described in systems previously mentioned. Perhaps no better outline of the Miller system can be given than the original one which appeared in the *American Bee Journal* for August, 1912, as follows:—

> "Into an empty brood-frame, at a distance of two inches to three inches from each end, fasten a starter of foundation about two inches wide at the top, and coming down to a point within an inch or two of the bottom bar. Put in the hive containing your best queen. To avoid having it filled with drone-comb, take out of the hive, either for a few days or permanently, all but two frames of brood, and put your empty frame between these two. In a week or so you will find this frame half filled with beautiful virgin comb, such as bees delight to use for queen-cells. It will contain young brood with an outer margin of eggs. Trim away with a sharp knife all the outer margin of comb containing eggs, perhaps a few eggs next to the youngest brood. This you will see is very simple. Any bee-keeper can do it the first time of trying, and it is all that is necessary to take the place of preparing artificial cells. Now put this 'queen-cell stuff,' if I may so call the prepared frame, into the middle of a very strong colony from which the queen has been removed. The bees will do the rest, and you will have as good cells as you can possibly have with any kind of artificial cells. You may think that the bees will start 'wild cells' on their own comb. They won't. At least, they never do to amount to anything, and, of course, you need not use those. The soft, new comb, with abundant room at the edge for cells, is so much more to their taste that it has a practical monoply of all cells started. In about ten days the sealed cells are ready to be cut out and used wherever desired."

### NUCLEUS HIVES.

In order to facilitate the work of queen-rearing, a few nucleus colonies should be run in conjunction with every apiary. In these small colonies queens can be raised and cared for until they are mated and laying. It is an easy matter, once the queens are laying, to transfer them to the larger hives in the apiary.

The best style of nucleus hive to adopt is the four-frame one. This size will give the young queen a chance to lay once she is mated, and will, besides,

hold sufficient bees to care for relays of queen-cells throughout the season. To form a nucleus colony take one frame of well-capped brood with adhering bees, and one frame containing honey and pollen, the remaining space being filled with an empty comb and feeder. If the number of bees on the comb is not sufficient to form a good cluster, one or two frames of young bees may be shaken into the nucleus, this being done to replace the field-bees which return to the old hive. Place the frame of brood in the middle of the hive and close the entrance until the following day, when the bees may be released. In the course of a day or two the small colony will settle down, and will then be ready to receive the first queen-cell.

Nuclei thus formed should be placed in a shady position until the bees are released. It is a good plan to set them a fair distance apart from each other and away from the main part of the apiary.

## COMPARATIVE FEEDING VALUE OF COARSE AND STANDARD RICE BRAN FOR GROWING PIGS*.

By Roberto H. Tirol.

Among the feedstuffs commonly available in many parts of the Islands is rice bran. There are in the market, however, different kinds of rice bran whose feeding value may not be the same. One kind is the standard or fine rice bran which comes from the large rice mills called the " Cono " mills. This standard rice bran consists of the cuticle of the rice kernel, the germ and a small amount of hull not separated in the milling process. The other kind is the coarse rice bran coming from the small rice mills called " Kiskisan " by the Tagalogs. This coarse rice bran consists of the hull, bran, polish as well as small particles of broken grain.

While the feeding value of the standard rice bran has been, to some degree, determined by feeding tests, no study has yet been made on the feeding value of the coarse rice bran. Considering that coarse rice bran is fed to pigs in many parts of the Islands it seemed advisable that a study be made on its feeding value, especially as more of this kind of rice bran is being used owing to the increase in use of the small rice mills.

The object of the experiment reported in this paper was to determine the comparative feeding value of coarse rice bran and standard rice bran.

### REVIEW OF LITERATURE.

Allas (1924) in his experiment on comparing rice bran, corn, and copra meal as supplements to sweet potato vines for growing pigs found that rice bran gave the best result as a concentrate supplement to sweet potato vines. He found that corn alone is not a good supplement. The rice bran and corn mixture, although better than corn alone, did not give as good returns as the rice bran alone.

Williams and McConnel (1922) in their study on rice bran for fattening hogs found that rice bran fed alone with tankage was not satisfactory, since it was unpalatable, too bulky, and produced the poorest gains. With corn chops and tankage, however, fairly good results were obtained.

---

* Thesis presented for graduation, 1932 with the degree of Bachelor of Science in Agriculture from the College of Agriculture No. 343; Experiment Station contribution No. 858. Prepared in the Department of Animal Husbandry, under the direction of Dr. Mariano Mondonedo.

Hughes and Mead (1922) studying rice and rice by-products as feed for fattening swine concluded that feeding whole rough rice with tankage is a practice of doubtful value. On the other hand, the feeding of rice by-products in combination with tankage and barley produces good market hogs economically.

Templeton and Clayton (1924) in their feeding experiments with swine at the Mississippi Experiment Station found that seventy-pound pigs fed on rations of rice polish and tankage with rye pasture, and rice bran and tankage, also with rye pasture, for 8 weeks did not do well and were unthrifty, indicating that these rations are not suitable for pigs of this size.

Fraps (1924) in his digestion experiments gave the composition of rice bran and rice polish as follows:—

| Feed. | Water. | Pretien. | Crude fiber. | Ether extract. | Nitrogen free extract. | Ash. |
|---|---|---|---|---|---|---|
| | per cent. | per cent. | per cent. | per cent. | per cent. | per cent. |
| Rice bran .. .. | 7·60 | 13·21 | 15·91 | 13·86 | 37·64 | 11·78 |
| Rice polish .. .. | 8·66 | 13·42 | 2·73 | 9·42 | 59·92 | 5·85 |

The coefficients of digestibility as found by him are as follows:—

| Feed. | Protein. | Ether extract. | Crude fiber. | Nitrogen free extract. | Productive value. |
|---|---|---|---|---|---|
| | per cent. | per cent. | per cent. | per cent. | per cent. |
| Rice bran .. .. | 72·20 | 89·04 | 32·31 | 68·32 | 65·65 |
| Rice polish .. .. | 75·00 | 88·21 | 8·20 | 94·32 | 92·24 |

Fraps (1904) studying the composition of rice by-products summarised his findings as follows:—Rice hulls have a low feeding value; their composition approximates that of wheat straw but with less value. Rice polish has a slightly higher feeding value than corn; it is about equal to oats or wheat.

According to this authority, there are three classes of rice bran as sold in Texas: (*a*) pure rice bran, consisting of the cuticle of the grain mixed with a small amount of hulls incidental to the process of milling; (*b*) rice bran mixed with rice hulls; and (*c*) rice bran mixed with rice polish and rice hulls. Commercial rice bran may contain as low as 4 per cent. protein and as high as 50 per cent. crude fiber.

Pure rice bran should contain not less than 10 per cent. protein and 6 per cent. fat, nor more than 20 per cent. crude fiber. Pure rice bran is slightly superior in composition to corn meal. Any addition of rice hulls lowers the feeding value of the mixture.

The mixture of bran, polish and hulls in the proportions in which they come from the grain contains about 7·5 per cent. protein and 28 per cent. crude fiber and has a little over half the value of pure bran.

Fraps (1916) in his studies on the composition of rice and its by-products found that huller bran, or rice bran removed by the huller, is rich in protein and fat and is practically free from hulls. Rice hulls have a very low feeding value, but there is no evidence that they are actually poisonous or injurious to animals. The production coefficients of rice by-products vary with the grade as does the productive value and the digestible protein.

Dust from rough rice contains much dirt and hulls and its presence in a feed is highly objectionable. Rice hull ash consists mostly of silica and has only an average fertilizer valuation of $1·38 per ton.

According to Fraps, the Texas Feed Control Service defines rice bran as follows:—

Rice bran is the cuticle of the rice grain with only such quantity of hulls as is unavoidable in the regular milling of rice. It must contain not less than 11 per cent. protein, 10 per cent. fat, and not more than 15 per cent. crude fiber.

The quantity of hulls in rice bran may be estimated from the quantity of crude fiber present. This estimate may be based upon the average composition of rice hulls.

The percentage of hulls may be calculated by the formula:—

$$X = \frac{F - R}{H - R}$$ Where $X$ = per cent. of hulls

$F$ = per cent. fiber in the bran
$R$ = per cent. fiber in the huller bran
$H$ = per cent. fiber in the hulls

Assuming that the average fiber in huller bran to be 8 per cent. and that of hulls to be 39 per cent. the formula becomes $X = \frac{F - 8}{39 - 8} = \frac{F - 8}{31}$

The quantity of hulls present for various grades would then be approximately:—

| *Crude fiber per cent.* | *Hull per cent.* |
|---|---|
| 8 | 0 |
| 10 | 6·4 |
| 12 | 12·9 |
| 15 | 22·6 |

The feeding value of rice bran and rice polish depends upon, (*a*) the quantity of digestible protein; (*b*) the productive value; and (*c*) the suitability to animals.

Since the values of rice bran and rice hulls are different, the proportion of hulls in rice bran, which can be judged by the crude fiber content, affects the production coefficients. The following productive coefficients of rice by-products are given by Fraps:—

*Productive coefficients of rice by-products.*

| | Protein. | Free extract | Crude fiber. | Nitrogen ether extract. | Coefficient of digestibility of protein. |
|---|---|---|---|---|---|
| Rice bran, 8 per cent. (8-9), 0 hulls .. | ·155 | ·540 | ·023 | ·217 | ·663 |
| Rice bran, 10 per cent. (9-11), 6·4 hulls .. | ·153 | ·539 | 0 | ·211 | ·654 |
| Rice bran, 12 per cent. (11-13), 12·9 hulls . | ·151 | ·538 | ·016 | ·205 | ·644 |
| Rice bran, 15 per cent. (13-16·5) 22·6 hulls | ·147 | ·536 | ·032 | ·196 | ·626 |
| Rice bran, 19 per cent. (16·5-19) 32·3 hulls | ·142 | ·533 | ·042 | ·185 | ·604 |
| Rice bran, 20 per cent. .. .. .. | ·138 | ·530 | ·048 | ·178 | ·508 |
| Hulls . .. .. .. .. .. | ·024 | ·318 | ·070 | ·087 | ·10 |
| Polish . .. .. .. .. .. | ·158 | ·490 | ·010 | ·227 | ·673 |

Fraps (1916) stated that "rice hulls have a productive value of approximately 3·2 pounds per hundred. That is to say, 100 pounds ground rice hulls will produce 3·2 pounds fat on an animal already receiving enough feed for maintenance."

Warren, (1923) in his experiments on rice bran and rice polish for growing and fattening hogs found that during the milling process, rough rice yields about 10 per cent. of rice bran and 3 per cent. of rice polish.

TIME AND PLACE OF THE WORK.

This work was conducted in the Department of Animal Husbandry, College of Agriculture, Los Baños. The experiment was begun August 4, 1930 and closed on March 1, 1931, thus covering a period of 210 days. The experiment was divided into three 70-day periods. The first period was a feeding test for 60-day old pigs; the second period for 130-day old pigs; and the third period for 200-day old pigs.

MATERIALS AND METHODS.

*Animals used.*

Eighteen Berkjala weanlings, nine castrated males and nine females, were used in this experiment. The pigs were fairly uniform in conformation, condition, and age. They were divided into three lots which were as uniform as possible as to weight, condition and sex.

*Feeds used.*

The feeds used were ground corn, coarse rice bran, standard rice bran, copra meal, and dried shrimps. The proportions by weight of the feeds used in the ration of each of the different lots were as follows:—

| Feeds. | Lot I | Lot II. | Lot III. |
|---|---|---|---|
| Corn .. .. .. | 20 parts | 20 parts | 20 parts |
| Rice bran (fine) .. | 60 „ | 0 „ | 30 „ |
| Rice bran (coarse) .. | 0 „ | 60 „ | 30 „ |
| Copra meal .. .. | 15 „ | 15 „ | 15 „ |
| Shrimps . .. .. | 5 „ | 5 „ | 5 „ |

The analysis of the two kinds of rice bran used in this experiment is as follows:—

*Showing the analysis of standard rice bran and coarse rice bran.**

| Feed. | Moisture. | Fats or ether extract. | Ash. | Protein N 6·25 | Crude fiber. | Carbohydrates N.F.E. | Calories per 100 grams. |
|---|---|---|---|---|---|---|---|
| Standard rice bran .. | 10·64 | 5·82 | 14·17 | 10·35 | 12·73 | 46·29 | 286·35 |
| Coarse rice bran .. | 10·48 | 1·11 | 15·03 | 4·25 | 24·48 | 44·65 | 210·81 |

* Analysed in the Department of Agricultural Chemistry.

To every 100 kilograms of grain mixture given in the tabulation, two kilograms of the following mineral mixture were added:—

| | |
|---|---|
| Common salt (NaCl) . .. .. | 0·95 kgm. |
| Ground corn-cob charcoal .. .. | 0·95 „ |
| Lime (CaO) .. .. .. .. | 0·10 „ |
| Total .. .. | 2·00 „ |

*Method used.*

*Allotment of pigs.*—There were three lots of six pigs each in this experiment. Lot I, as the control, was given the mixture containing the fine rice bran; lot II was given the same ration mixture except that coarse rice bran was

used instead of the fine rice bran, and lot III received a similar ration except that only one-half of the amount of fine rice bran used in lot I and one-half of the same amount of coarse rice bran used in lot II were used.

*Duration of experiment.*—The work was carried for 210 days divided into three 70-day periods, each of which may be considered a complete experiment in itself. No re-allotment of pigs was made as the experiment passed on from one period to another.

*Weighing.*—Each pig was weighed on three consecutive days and the average was taken as the initial weight. The final weight was taken in like manner. During the whole course of the experiment, individual weekly weights were taken in the afternoon just before the pigs were given their evening meal.

## CARE AND MANAGEMENT.

### *Feeding.*

The pigs were hand-fed twice daily, at 5:00 to 6:00 a.m. and 5:00 to 6:00 p.m. They were given as much feed as they would readily consume.

### *Handling of the pigs between meals.*

During the first period, all the pigs after each feeding were driven into one of the one-fourth hectare grass pastures. At noon they were driven to the hog house to wallow and to drink. They were then driven back to the pasture. After feeding in the afternoon, the pigs were placed in the hog house for the night.

On October 1, 1930, when experiment II was begun, the pigs were turned into a good pasture of mungo. They remained in this pasture until about the end of the month. From November to the end of the study they were turned again on grass pasture. The pigs in each lot were trained to enter their respective pens at feeding time. Except for the difference in the three rations the animals received the same treatment throughout the whole period of the experiment.

### *Observations.*

*First 70-day period.*—Lot I pigs (standard rice bran) consumed the most feed and in the shortest time. They made the fastest gain. They were healthy and in fine condition throughout the experiment.

Lot II pigs (coarse rice bran) consumed the least feed and took the longest time. They did not appear to relish their feed. Some of the pigs gradually lost weight and with all of them the hair began to be rough.

Lot III pigs (standard and coarse rice bran) were second in respect to the amount of feed they consumed and the length of time it took them to eat their meals. Their appetite was only a little better than lot II. Throughout the period they were intermediate in condition between lots I and II.

*Second 70-day period.*—Lot I took the shortest time to eat their meals and consumed the most feed. The animals in this lot were in excellent health throughout the whole period and had a fine glossy coat of hair.

Lot II continued to take the longest time to eat their meals. They were thin and their coats were rough. Most of them were in poor health and appeared listless.

Lot III was second in the amount of feed consumed and in the time it took them to finish their meals. The animals were in medium health but their coat of hair became coarse. They developed a better appetite than in the first period and made fairly rapid gains in weight.

*Third* 70-*day period*.—Lot I continued to have the best appetite. The pigs continued to make the most rapid gains in weight. Throughout the whole period the animals were in excellent health and condition. All of them had a sleek and fine appearance at the close of the experiment.

Lot II consumed the least feed and took the longest time. The animals had very poor appetites. With the exception of two animals, all were extremely thin, scrawny and pot-bellied with long rough hair and listless eyes. Animal F 1090 died on December 25, 1930 from kidney worms and general debility. On January 14, 1931, animal Bb 1096 died of chronic inflammation of the stomach and emaciation. On February 3, 1931, animal F 1082 died of kidney worms. For three days before it died, it refused to eat. On February 7, 1931, animal Bb 1098, died of kidney worms and general weakness. At the end of the experiment only two animals remained alive and these had rough coats and were ragged in appearance.

Lot III was second in the amount of feed consumed and the time it took them to finish their meals. The animals ate their feed heartily and made fairly rapid gains in weight. On February 18, 1931, pig 1097 became lame. This condition was observed in the other pigs but less pronounced. After a few days, however, the pigs recovered from this affliction. At the close of the experiment the animals were healthy and moderately fat, but rough in appearance.

## DISCUSSION OF RESULTS.

*Summary of results.*

| | Lot I. | Lot II. | Lot III. |
|---|---|---|---|
| *First* 70-*day period*— | | | |
| Average daily gain in weight | 0·15 kgm. | 0·04 kgm. | 0·05 kgm. |
| Feed consumed per kgm. gain | 3·44 ,, | 6·92 ,, | 7·83 ,, |
| Feed cost per kgm. gain | ₱0·20 | ₱0·28 | ₱0·38 |
| *Second* 70-*day period*— | | | |
| Average daily gain in weight | 0·28 kgm. | 0·08 kgm | 0·18 kgm. |
| Feed consumed per kgm. gain | 3·97 ,, | 7·20 ,, | 4·72 ,, |
| Feed cost per kgm. gain | ₱0·22 | ₱0·30 | ₱0·23 |
| *Third* 70-*day period*— | | | |
| Average daily gain in weight | 0·33 kgm. | 0·04 kgm. | 0·17 kgm. |
| Feed consumed per kgm. gain | 5·22 ,, | 24·76 ,, | 8·14 ,, |
| Feed cost per kgm. gain | ₱0·28 | ₱0·90 | ₱0·37 |
| *Combined* 210-*day period*— | | | |
| Average daily gain in weight | 0·25 kgm. | 0·06 kgm. | 0·14 kgm. |
| Feed consumed per kgm. gain | 4·41 ,, | 11·50 ,, | 6·57 ,, |
| Feed cost per kgm. gain | ₱0·24 | ₱0·46 | ₱0·31 |

*First* 70-*day period*.—It may be seen in the "Summary of Results" that in rate of making gain lot II with coarse rice bran in the ration was only 27 per cent. as efficient as lot I, the best of all the lots. Lot III compared with lot I was 38 per cent. as efficient.

The principal reason for lot II giving the poorest results was that the pigs found their feed unpalatable and so consumed very little of it. In lot III, however, where there was an equal part of fine rice bran to every part of the coarse rice bran present in the ration, the pigs consumed more feed than did those of lot II.

From the standpoint of feed needed to make a given unit of gain, it is obvious that lot II was only 50 per cent. and lot III, 44 per cent. as efficient as lot I. In other words, lot III in this regard was actually poorer than

lot II. It appears that to form the ration of lot III, the substitution of an equal amount of fine rice bran for half of the amount of coarse rice bran used in lot II was an improvement, but only to the extent of improving the palatability of the ration. For lot III pigs were able to consume a ration of 40 per cent. more than the pigs in lot II were able to take and consequently they made more rapid gains. The good effect, however, was not sufficiently marked to overcome the ill effects of feeding coarse rice bran to young growing pigs.

Although coarse rice bran costs only half as much as fine rice bran, yet its effect upon the gain in weight of the pigs was such that there was a marked difference between the cost of the gains made by the lots. In lot I it took $0·20 worth of feed to make a kilogram gain; in lot II, $0·28; and in lot III, $0·38.

*Second* 70-*day period.*—In this second period (see " Summary of Results ") the fine rice bran remained the best, with lot III very much better than lot II. It is interesting to note that during this period the cost of feed per kilogram gain made by the pigs in lot III was about the same as in lot I. This brings out the fact that the unsuitability of coarse rice bran for feeding purposes became less marked as the pigs grew older, provided, of course, that they were given a sufficient amount of the other feeds to make the ration fairly balanced.

*Third* 70-*day period.*—(See " Summary of Results.") The fine rice bran lot made the most rapid gain, keeping the lead from the first period till the end of the experiment. Lot II, on the other hand, made no improvement at all.

It is important to note that while the pigs in lot I remained healthy and in good condition till the end of the experiment, the pigs in lot II were all very thin and sickly looking. Four of these died during this period from kidney worm infection and general debility. One died of chronic inflammation of the stomach. There is no doubt that the primary cause of death was insufficient nourishment. This agrees with the findings of Boncato (1932) in his study on the efficiency of the different methods for controlling stomach and intestinal worms in sheep and goats. He arrived at the conclusion that good feeding is a better measure in promoting good health and in reducing parasitic infestation of the animals than feeding them poorly and treating them with copper sulphate or copper-sulphate-nicotine solution.

The pigs in lot III, although moderately healthy, had the rough coats and ragged appearance of the pigs in lot II.

*The three periods combined.*—The outstanding result obtained in combining the partial results obtained from the three partial periods is that the fine rice bran lot made the most rapid gain in weight, the fine and coarse rice bran lot, second, and the coarse rice bran, the poorest. Lot I made an average daily gain of 0·25 kilogram; lot II, 0·06 kilogram; and lot III, 0·13 kilogram.

In the amount of feed required to make a kilogram of gain, lot I required 4·41 kilograms; lot II, 11·50 kilograms; and lot III, 6·57 kilograms.

From the standpoint of economy of gain, the fine rice bran lot was always the first, the coarse and fine rice bran, second, and the coarse rice bran lot the last. Thus, the feed cost per kilogram of gain in weight in lot I was $0·24; in lot II was $0·46; and in lot III, $0·31.

Estimating, however, from the economic point of view, that is, according to the saleable gain in weight at the end of the 210-day period, lot II was a

losing proposition. The total final weight of lot II was 71 kilograms and the total initial weight was 52·90 kilograms, leaving a total gain of 18·10 kilograms during the feeding period of 210 days. To make this gain the lot consumed 602·2 kilograms of feed. Thus, the lot required the consumption of 33·27 kilograms of feed worth ₱1·31 to make a kilogram of gain.

One of the most important and interesting results, which became more evident as the experiment progressed, was the appearance of the pigs in the three lots. While the pigs in the fine rice bran lot were uniformly healthy and sleek looking with a fine coat, the pigs in the coarse rice bran lot were ailing practically all the time; were scrawny and had rough coats.

## CONCLUSIONS.

1. Assuming the feeding value of the ration containing fine rice bran to be 100 per cent. then the ration containing rough rice bran was found to be only 38 per cent. in feeding value, and the ration containing coarse and standard rice bran in equal proportions was found to be 67 per cent.

2. Assuming the feed cost per kilogram gain of the ration containing fine rice bran to be 100 per cent. then the ration containing rough rice bran was found to cost 92 per cent. more than the fine rice bran, and the ration containing rough and fine rice bran in equal proportions was found to cost 29 per cent. more than the fine rice bran.

## LITERATURE CITED.

Allas, Teofilo P. 1924. Rice bran, corn, and copra meal as supplements to camote vines for growing pigs. The Phillippine Agriculturist 13: 255–259.

Boncato, P. C. 1932. A study on the efficiency of the different methods for controlling stomach and intestinal worms in sheep and goats. The Philippine Agriculturist 20: 669–677.

Fraps, G. S. 1904. The composition of rice by-products. Texas Agric. Sta. Bull. 73: 14. *Cited in the* U.S. Dept. Agric. Exper. Sta. Rec. 16: 1107. 1904.

Fraps, G. S. 1916. The composition of rice and its by-products. Texas Agric. Sta. Bull. 191: 41. *Cited in the* U.S. Dept. Agric. Exper. Sta. Rec. 37: 363. 1918.

Fraps, G. S. 1924. Digestion experiments with oat by-products and other feeds. Texas Agric. Sta. Bull. 315: 3–12. *Cited in the* U.S. Dept. Agric. Exper. Sta. Rec. 51: 467. 1924.

Hughes, E. H. and — Mead. 1922. Rice and rice by-products for fattening swine. California Sta. Rpt. 1922: 56–58. *Cited in the* U.S. Dept. Agric. Exper. Sta. Rec. 48: 571. 1923.

Templeton, G. S., and E. P. Clayton. 1924. Feeding experiments with swine at the Mississippi Station. Mississippi Agric. Sta. Rpt. pp. 10–14. *Cited in the* U.S. Dept. Agric. Exper. Sta. Rec. 55: 565. 1926.

Warren, G. R. 1923. Rice bran and rice polish for growing and fattening hogs. Texas Agric. Sta. Bull. 313: 1. 1923.

Williams, D. W., and O. E. McConnel. 1922. Rice bran for fattening hogs. Texas Agric. Exper. Sta. Bull. 286: 7–15. *Cited in the* U.S. Dept. Agric. Exper. Sta. Rec. 47: 474. 1922.

## VITAMINS.

VITAMINS are substances of unknown composition present in varying concentration in most fresh animal and vegetable foods and necessary for the normal processes of metabolism. The absence or insufficiency of vitamins in the food is responsible for various ailments.

| Name. | Common descriptive name. | Solubility. | Present in | Absence causes. |
|---|---|---|---|---|
| Vitamin A .. | .... | Fat soluable .. | Butter, milk, cheese, beef or mutton fat, green vegetables and fruit. Yellow vegetables. | Ulceration of eyes, ricketts, retarded growth, vulnerability to disease. |
| „ B .. | Anti neuritic .. | Water soluable .. | Seeds, eggs of animals, cereals (whole grain), (not in husk of white maize), fruits, vegetables and yeast. | Diseases of nervous system, paralysis or beriberi. |
| „ C .. | Anti scorbutic .. | Water soluable .. | Vegetables, green leaves, citrus fruits, living and freshly killed animal tissues. | Scurvy. |
| „ D .. | Anti rachitic .. | ..... | Plant and animal sterols present in oils and fats and formed by action of ultra violet rays upon ergosterol. Its presence is necessary for the metabolism of bone formation. | Rickets. |
| „ E .. | Anti sterility .. | ..... | The oil of the wheat germ, oats, corn, coconuts, olives, cotton seed oil, egg-yolk and lettuce. | Sterility (even in presence of abundance of A and B). |
| „ G .. | .... | ..... | ..... | Poor growth and unhealthy skin and mucous membranes. |

NOTE.—The vitamin content of all foods is largely destroyed by cooking.

## GENERAL SECTION.

### EFFECT OF WEED-KILLERS ON THE SOIL.

(From *Nature*, Vol. 131, 1933, p. 880.)

A QUESTION of importance in the use of chemicals for weed eradication is the possibility of such compounds exerting a deleterious effect on the soil, with risk of injury to the subsequent crop. Some investigations on these lines have been carried out by W. E. Bowser and J. D. Newton both in the field, greenhouse and under controlled conditions (*Canadian J. Research*, 8, 73). The liability of damage depends in part at least on the rate of decomposition of the chemical, its rate of movement in the soil and its effect on microbiological activity. Sulphuric acid and copper sulphate, which are employed chiefly as leaf sprays for the suppression of annual weeds, showed no lethal effect on the soil and nitrification was not affected. Sodium chlorate, on the other hand, which is mainly used for the eradication of perennials, remained undecomposed for a considerable time, poisonous effects being found nearly two years after application had been made. The rate of decomposition, however, was accelerated in the presence of much organic matter, and further, leaching removed the toxic compound from the surface layers of the soil, facts which suggest that a shallow rooted crop supplied with a good dressing of an organic manure would be advisable after a sodium chlorate treatment. Sodium bichromate decomposed rapidly, showing no residual toxic effects, but both this compound and sodium chlorate were alike in exerting a depressing influence on the numbers of soil micro-organisms.

### ABSTRACT.

THE following abstract " A Survey of Oil Seeds and Vegetable Oils," Vol. 11, " Coconut Palm Products " was published under the signature H.D.M. in the March issue of the *Malayan Agricultural Journal* and in view of its special interest to Fijian planters is reprinted below.

#### WORLD INDUSTRY IN COCONUT PALM PRODUCTS.

Abstract of " Survey of Oil Seeds & Vegetable Oils," Vol. II, " Coconut Palm Products."

*A summary of Production and trade in the Empire and Foreign Countries. Prepared by the Statistics and Intelligence Branch of the Empire Marketing Board. December*, 1932. *Printed and published by His Majesty's Stationery Office, London.* 196 *pages, with eight illustrations and diagrams price* 2*s.* 0*d. net.*

The estimated world's acreage under coconuts in 1930 was about 7¼ million acres as compared with 5½ million acres in 1921, an increase of about 30 per cent. during the 10 year period. In both years the British Empire countries accounted for slightly more than half of the world acreage.

#### WORLD PRODUCTION AND EXPORTS OF COPRA.

An estimate of the world production of copra based on the figures of acreage and the assumption that 2½ acres of palms yield 1 ton of copra, shows that about 3 million tons of copra are now produced annually. It is estimated that over 40 per cent. of the total production is consumed in the countries of origin.

World exports of copra declined from 1·17 million tons in 1928 to 1·04 million tons in 1930 and, it is stated in this survey, the exports of 1931 were expected to show a further slight decrease. This slight decline is in part due to the increased production of coconut oil in the copra producing areas and to the diminution of prices in the world markets.

Netherlands India and the Philippine Islands supplied nearly 65 per cent. of the whole before the war, whereas they now supply little more than 50 per cent. whilst British Empire countries have increased their combined shares from 20 per cent. to 40 per cent. of the whole. Malaya, in 1930, produced 10 per cent. of the world supplies.

### WORLD EXPORTS OF COPRA AND COCONUT OIL.

Owing to the rapidly increasing export trade in coconut oil from copra producing countries in recent years, the figures for this commodity should be considered together with those of copra in order to obtain a comprehensive view of the situation. This increasing export of coconut oil indicates that the crushing industries in the copra producing countries are sucessfully competing with those in the centres of consumption and this tendency may be expected to increase, since labour is generally cheaper in the countries of origin. Furthermore the oil produced from fresh copra has a lower free fatty acid content than that produced from stale copra which has been stored for lengthy periods. Exports of coconut oil from copra producing areas now exceed 200,000 tons per annum of which the British Empire countries furnish over 20 per cent. The Philippines and Ceylon are by far the chief copra producing countries exporting coconut oil, the former exporting about 60 per cent. of its total copra production as coconut oil.

The total net world exports of both copra and coconut oil in terms of copra* reached a peak of over 1½ million tons in 1929, declining to 1⅓ million tons in 1930, of which, in 1930, 23·2 per cent. was in the form of coconut oil.

The percentage share of coconut oil in the aggregate exports was 19·8 in 1926, 23·6 in 1927, 22·3 in 1928, 26·4 in 1929 and 23·2 in 1930.

### COMPARATIVE EXPORTS OF DIFFERENT COUNTRIES.

Although Netherlands India is by far the largest exporter of copra, when exports of copra and coconut oil are combined the greatest share of the world supply of both commodities entering international trade is that of the Philippines which was 29·3 per cent. in 1930 as compared with 28·6 per cent. from Netherlands India in the same year. The next most important shares are those of the British South Sea Islands, Ceylon and Malaya which supplied 11·6, 11·1 and 8·7 per cent. respectively.

It is interesting to note that the next most important share of supply of the two commodities is that of the foreign territories of the South Sea Islands which, in 1930, amounted to 3·2 per cent. of the whole.

### PRINCIPAL COPRA IMPORTING COUNTRIES.

Before the war, Germany was the principal importer of copra with France a close second. After the war, Germany recovered her premier position for a short period but lost it to the United States of America in 1926.

In 1931 net imports of copra in thousand tons, into the principal importing countries were:—United States 192, France 192, Germany 143, Netherlands 85, United Kingdom 80, and Denmark 70 thousand tons.

* 65 tons of coconut oil = 100 tons of copra.

CONSUMPTION OF COCONUT OIL IN THE PRINCIPAL CONSUMING COUNTRIES.

The demand for coconut oil is largely dependent upon the margarine and soap industries and the available figures of margarine production indicate a marked reduction in the past two years. Soap production has been much more stable than that of margarine in recent years and the popularity of hard soaps has resulted in an increasing proportion of coconut and palm kernel oil in the raw material utilised. The utilisation of these two oils in the soap industry is likely to increase if this tendency continues and the choice between the one or the other will be largely decided by their relative price movements.

The consumption of coconut oil in the principal consuming countries outside the copra producing areas reached a peak of 870 thousand tons in 1929. In 1930 there was a decrease of about 14 per cent. in the consumption and a further decline of about 5 per cent. in 1931.

OTHER COCONUT PRODUCTS.

*Fresh Coconuts.*—The trade is comparatively small and localised. About 110 million nuts were exported in 1930 for consumption as nuts and for shredding. Jamaica, Ceylon and Malaya are the principal exporters and the United States is the principal importer.

*Shredded and Desiccated Coconut.*—Ceylon and the Philippine Islands are the main sources of supply, about 50 thousand tons being exported from these countries annually.

*Coir.*—Ceylon and India are the chief exporters of this commodity. Exports from the latter country are almost entirely in the form of manufactured products.

*Coconut Cake and Meal.*—The main sources of world supply are Ceylon, India, Netherlands India and the Philippines. The amount exported now exceeds 150 thousand tons.

DEMAND FOR COCONUT PRODUCTS IN THE UNITED STATES OF AMERICA.

Coconut oil is by far the most important ultimate product of the coconut palm and the future prospects of the industry depend almost entirely upon the demand for this oil. The war and post-war periods have witnessed a heavy increase in demand which has been largely the result of developments in the United States of America. Since the war that country has been the largest single consumer of this commodity, about one-third of the world's supplies now finding their outlet there. American demand is largely satisfied by Philippine production, and Philippine production is largely absorbed by American demand. Since 1925, Philippine produce has constituted about 80 per cent. of the estimated volume of coconut oil consumed in America, and America has taken between 80 and 90 per cent. of the Philippine exports of copra and coconut oil. It is thus clear that the United States of America and the Philippines, as far as coconut palm products are concerned, constitute almost a self-contained group and that the coconut palm industry outside the Philippines is likely to remain very largely dependent upon European consuming centres as an outlet for its surplus production.

Recently, a further aspect of this question has revealed itself, namely, the effect of a substantial reduction in the American demand for coconut palm products. The decrease in the apparent consumption of coconut oil in the United States during the present depression has released appreciable supplies of Philippine produce for marketing elsewhere, particularly in Europe

since the American consumer can, of course, reduce his demand much more rapidly than the Philippine producer can reduce his supply. As a result, exports of Philippine copra to France, for instance, increased from an average of about 7,000 tons in the period 1928-30 to 22,000 tons in 1931, and exports of Philippine coconut oil to the United Kingdom increased from an average of about 250 tons in the period 1928-30 to about 14,000 tons in 1931. This development shows that although the United States and the Philippines are largely interdependent as regards coconut palm products, maladjustment between supply and demand can have repercussions on the other producing and consuming areas, and that if American demand fails to keep pace with Philippine production—there were in 1931 over 200,000 acres of coconut palms in the Philippines not yet in full bearing—the European market may find itself subjected to a substantial increase in the offerings of Philippine copra and coconut oil, to the detriment, of course, of marketing possibilities of the produce of other coconut areas.

### DEMAND IN EUROPE.

Since 1924, there has been no evidence of any marked increase in the demand for coconut oil in the European countries taken as a whole. The apparent consumption in the United Kingdom, France, Germany, Denmark, Italy, Norway, the Netherlands and Czecho-Slovakia, which constitute the most important consuming centres of Europe, amounted to about 400,000 tons per annum in the period 1924 to 1927 and about 430,000 tons per annum in the period 1928 to 1931. The development of demand in Europe has been seriously hindered by the increase in supplies of ground nuts and other competing oilseeds, but particularly by the heavy production of whale oil which is largely absorbed in the European margarine and soap industries. Whale oil production increased from 130,000 tons in 1924–25 to 600,000 tons in 1930–31. The serious price fall in whale oil in recent years has resulted in drastic cuts in the whaling plans for 1932–33, the estimated production for which is 300,000 to 400,000 tons, and if these plans materialise the European demand for coconut oil should appreciably benefit.

### FUTURE SUPPLIES.

A longer view of the situation suggests that the supplies of coconut palm products should continue to expand as the areas under cultivation, which increased by about 30 per cent. between 1921 and 1930, come into full bearing. Moreover, the world exports of copra and coconut oil in 1930 and 1931 were much below the peak of 1929, thus indicating that supplies could in any case readily respond to an increase in demand. Future supplies are therefore assured, and the expansion of demand is undoubtedly the principal factor upon which the future prosperity of the industry depends. The demand for coconut oil, which, as has already been pointed out, is by far the most important form in which the coconut enters into final consumption, depends on the one hand on the growth of the soap and of the margarine industries and on the other hand, on the competition of other vegetable oils and fats and animal and marine fats utilised in these industries.

### SUBSTITUTION OF COCONUT OIL BY OTHER OILS.

The expansion of the soap and margarine industries should continue with the general increase in population and with a resumption of the rise in the standard of living. As regards the substitution of one oil or fat for another in these industries, the prospects are not so easy to define. Substitution is primarily dependent upon the special properties which the competing

fats possess and with the widened uses for inferior oils brought about by improvements in technical processes. The large increase in the share of coconut oil in the oleo-margarine industry in the United States of America and its increased utilisation in the soap industry of the United Kingdom in recent years may be attributed to the special characteristics which it possesses and the special qualities which it gives to these commodities. But price considerations also play an important part in the choice of substitutable oils and fats, and over a relatively short period the price factor is probably the more potent. It remains to be seen whether the net results of the efforts being made to reduce the costs of competing vegetable oils and the probable rise in price of animal and marine fats resulting from the restriction in the world's livestock population and the whaling catch will be such as to permit of the more effective competition of coconut oil with substitutable oils and fats such as tallow, palm oil, palm kernel oil, groundnut oil, cottonseed oil and whale oil.

## THE AVOCADO PEAR,

In view of the fact that this fruit is said to be a valuable food for diabetes patients, but is at present practically unknown in New Zealand, although much valued in America, there seems little doubt but that there will some day be a solid demand for it in that country. The following article, extracted from * "The Cultivation of Fruits in Ceylon with Cultural Details" may therefore prove of interest to Fijian Planters.

AVOCADO PEAR.

Avocado Pear (*Persea gratissima*)—known also as the Spanish Pear and Soldier's Butter, but most commonly as the Avocado—or Alligator Pear and Et-pera, S. Though generally classified as a fruit tree it is rather as a salad that it is appreciated than as a dessert fruit. The Western tropics and parts of the Eastern tropics hold the fruit in much esteem on account of its nutritious properties, and it is accordingly commonly grown in Central America, West Indies, Mexico and Hawaii.

Compared to most others the Avocado is a new fruit of the tropics and certainly as yet not well known or sufficiently appreciated in Ceylon. The actual date of its introduction here is in doubt, but the variety found in Ceylon thrives excellently at elevations between 1,000 to 3,000 feet in the moist zone. America has made great strides in the culture of the Avocado and the Californian Avocado Association, organised in 1914, has exerted considerable influence in effecting its improvement. The United States Department of Agriculture had previously, however, through its Agricultural Explorers, obtained the seed and bud material of the best varieties from all sources in order to give the industry the best possible start. The Association renders valuable services in studying the numerous varieties in cultivation, recommending only those of standing merit and suitability for commercial planting, and its literature affords a valuable contribution and is of great assistance to the grower. A Co-operating Marketing Agency, the Calavo Growers of California, was founded in 1924 to cope with the marketing of the rapidly increasing crops and is functioning satisfactorily at the present time. Hawaii too has an organisation and produces excellent fruit for export to American ports.† The existence of these associations shows with what zest this fruit is being encouraged in America.

* *The Tropical Agriculturist*, Ceylon, Vol. LXXX, No. 1, Jan., 1933.

There are two distinct species of avocado—*Avocado gratissima* (syn. *Avocado americana*) embracing the West Indian and Guatemalan types of which fruit the Ceylon plant is a variation though not a good one, and *Avocado drymifolia* of the Mexican highlands, a tree not yet known to Ceylon except at Peradeniya and which is a more hardy plant, sub-tropical, and of probable utility in the high elevations of Ceylon. There are many cultivated forms of each group, the former being characterised in general by large fruits with a thick skin of leathery texture and the latter by smaller fruits with a thin membranous skin, but both species vary in size, shape and colour, from one to three pounds in weight, from round to oval and pear shaped fruit, and in colour from green to purplish black. The fruit is single seeded, the fleshy edible portion being that between the seed and the skin. The flesh is of buttery consistency, of nutty flavour, cream coloured, and contains a large percentage of vegetable oil, in some cases as much as 18 per cent., very appetising and most nourishing and is eaten by scooping the flesh out with a spoon and partaken of either plain or flavoured with salt and pepper, the latter being the usual way.

The tree attains a moderate height of 20 to 25 feet, the West Indian varieties being suited to an elevation of 1,000 feet to 3,000 feet in the moist regions and the Mexican varieties at elevations of 2,500 feet to 5,000 feet. Dry atmospheric conditions are not suited to either, and exposed windy sites should be avoided. The nature of soil required fortunately presents no difficulties since it thrives on a wide range of soils varying from that of a light sandy nature to a heavy but not too clayey loam. A good deep soil of medium texture with good drainage will produce the best results, and sites with a subsoil of hard pan or rock less than 4 feet below surface should be avoided.

Propagation locally is by seed but the Avocado does not as a rule come true to type. Propagation should be by budding and that on the rectangular patch or shield system as employed for rubber which has to date been more successful at Peradeniya than either grafting or " T " budding. The local common variety is a robust tree and admirably answers the purpose of a stock plant for the West Indian varieties for the elevations given. For an elevation of 4,000 to 5,000 feet the Mexican stock is required and application for seeds or plants of this has been made to America for trial in the up-country districts of Ceylon.

The seed is large, often 2 inches in diameter, and should be sown on removal from the fruit and planted either singly in large bamboo pots or preferably in well prepared beds of loose and sandy soil at distances of one foot apart and 18 inches between the rows, care being taken that the pointed end of the seed is uppermost.

Germination is fairly rapid and the seedlings are ready for removal to permanent sites or for budding at 6 to 8 months of age, at which age the seedling has attained a stem diameter of fully half an inch. Shield budding is recommended, the buds being obtained from well ripened wood and selection made of the more plump buds. The bud shield should be not less than 1½ inches in length, the use of smaller wood having been proved to be much less successful. The subsequent procedure is that adopted for citrus budding and the budded seedlings should be ready for transplanting to the orchard or compound at six months from budding.

---

† Whilst Hawaii produces excellent Avocado pears, the Editor understands that they do not export to the D.M.A.

Planting distances of 21 ft. by 21 ft. are normally sufficient but certain varieties and seedlings require more space and 25 ft. by 25 ft. should be the maximum.

There is sometimes a tendency, mostly with seedlings however, for the plant to shoot up and not spread as it should. The terminal shoot of such plants should therefore be cut back to encourage a branching habit. Pruning is not often required except in the removal of weakly branches or any dead wood. All cuts made should be clean and carefully attended to and painted with a wood preservative. In Ceylon the tree is normally of healthy growth but is subject to attack by stem boring caterpillar, thrips, and mealy bug. These troubles are remedied by cutting out the growth affected by the stem borer, and by emulsion sprays for leaf attacks.

It should be borne in mind that the Avocado is a rapid grower and a gross feeder and good supplies of well-rotted manure should be forked into the soil around the tree at regular intervals, preferably a good dressing just prior to each monsoon.

With regard to cropping, a mature tree will give from a few dozen to many hundreds of fruit, usually according to size of fruit. Varieties producing very large fruit are considered good bearers if 4 to 5 dozen fruits are obtained, but on the other hand a full grown seedling tree will give nearly 1,000 small fruits. The majority of the best varieties in commercial cultivation however give medium sized fruits—the market requisite—and 200 to 300 fruits can be considered a good crop for a normal sized mature tree.

The varieties mostly in favour with growers, and recommended for Ceylon are the " Trapp," " Pollock," " Dickinson," " Dutton," " Lyon," " Mayapan," and " Winslowson " of the thick skinned West Indian and Guatemalan varieties and " Gantor," " Gottfried," " Northrop," " Puebla," among the Mexican and colder region varieties. The purple or maroon coloured Avocado fruits are at present a novelty in Ceylon but there are many varieties bearing such, a tree of the " Gottfried " having recently fruited at Peradeniya the fruit being of most attractive colour and the pulp of acceptable nutty flavour. The purple skinned varieties of the above are " Dickinson," " Dutton," " Mayapan," " Gottfried," " Northrop " and " Puebla."

---

**IN MEMORIAM,**

Ratu George Cokanavula, Fourth Class Clerk, Agricultural Department, who died on 10th June, 1933, as a result of an accident when playing football.—Deeply regretted by his colleagues.

---

CONTENTS.